STATE & PRIVATE FORESTRY
FOREST HEALTH PROTECTION
SOUTH SIERRA SHARED SERVICE AREA

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Subject: Recent Bark Beetle Activity on Hume Lake Ranger District, Sequoia National Forest

For the past few years, Western Pine Beetle has caused widespread mortality in natural stands and plantations of ponderosa pine throughout the southern Sierra Nevada. Private lands and wildland-interface areas within the Hume Lake Ranger District were especially affected last summer 2009 (see Figure 1). On April 19, 2010 Forest Health Protection was requested to evaluate the current mortality, assess the potential for continued attacks, and examine extensive tree damage associated with winter storms. Recommendations for prompt and preventive treatments are the most effective strategy in managing bark beetle-associated mortality.

Figure 1. *Scattered mortality of Ponderosa pines caused by Western Pine Beetle in the Hume Lake Ranger District, Sequoia National Forest*

Introduction

Western Pine Beetle (*Dendroctonus brevicomis*,WPB) is a native bark beetle that principally attacks Ponderosa pines in the Sierra Nevada. Successful mass attack requires mating beetles to overcome tree defenses, eventually killing trees to provide suitable brood material for larval development. Therefore, beetles typically target hosts predisposed by inter-tree competition, resource stress, disease, or have prior injury (ex: mechanical damage). Endemic activity of WPB remove selected hosts to provide space and nutrients for new trees; group kills of 3-10 trees are common in dense, overstocked stands where trees compete for water, light, and space. Continued mortality by WPB are considered at outbreak when group kills move beyond acceptable levels due to abundance of susceptible hosts. Prolonged drought events exacerbate trees with physiological stress, thereby promoting beetle population expansion. Large-scale tree mortality in southern California was directly related to several preceding years of drought (Forest Health Protection, 2002).

The winter of 2006-2007 was an exceptionally low rainfall year for California – a record low not experienced since 1994. Precipitation that single winter was lower than the previous drought six-year event 1999-2004 (see Figure 2). Aerial surveys conducted in the following years 2008 & 2009 found pine mortality significantly increased each year. In the south Sierras, ground surveys observed mortality frequently in the large diameter ponderosa pines (greater than 20 inches) in diverse natural stands, rather than small-diameter plantations. Despite the above normal water season this winter (2009-2010), detected tree mortality may continue at similar rates.

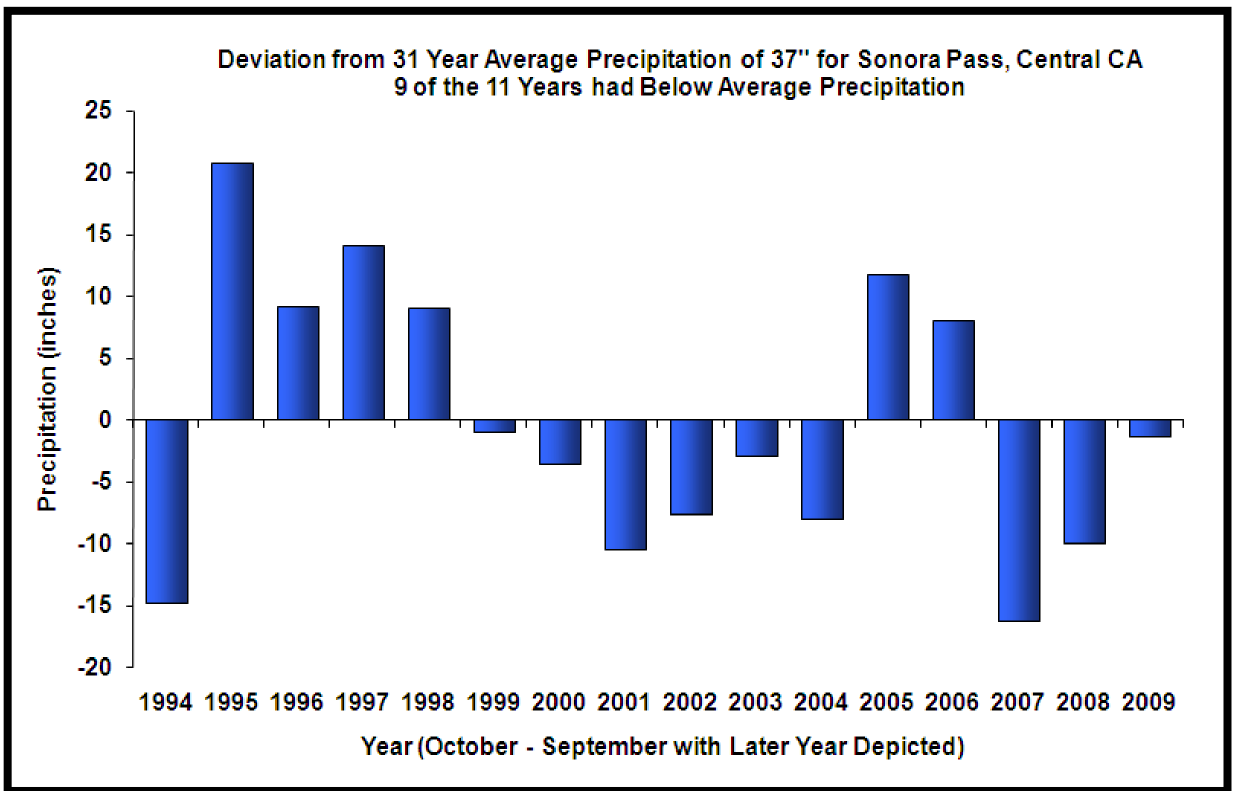

Figure 2. *Precipitation records from 1994-2009. NOTE: Information at Sonora Pass SNOTEL station was representative of most conditions in the southern Sierras.*

Figure 3. *Snow break in Armillaria infected oak.*

Figure 4. *Western Pine beetle mortality around homes in Pinehurst.*

In addition to drought, two powerful storms during late January and mid-March 2010 caused extensive snow loading and windthrow damage in national forests throughout the Sierra Nevada. Hume Lake Ranger District on the Sequoia National Forest and surrounding communities experienced both significant loss of mature pines by WPB and mechanical damage by weather events (see Figure 3). Several hundred acres of general forest were affected including private backyards, campgrounds, and along roadsides. Group kill by WPB ranged from 4-20 trees per infestation site, trees greater than 15 inches. Western Pine beetle attacked groups of mature pines adjacent to homes in Pinehurst creating hazardous situations (see Figure 4). Along Cedar Creek and campground, several individual ponderosa pines larger than 30 inches were successfully mass attacked, various with previous pine engraver (*Ips* species) activity in the upper crown. Composition of affected stands visited contained over 80% incense cedar with scattered remnant pines in severely overcrowded conditions (see Figure 5).

Figure 5. *Representative mixed conifer stand along Cedar Creek drainage. Note density of cedar compared to pine; ponderosa on the far left was attacked by WPB.*

General forest stands were evaluated to have 260 ft^2/acre and greater basal areas – considered high risk for beetle attack in pines (Oliver 1995). However, stands previously thinned and burned that would not have been expected to be attacked, still experienced loss (see Figure 6). Limb breakage and whole tree toppling from wind was mainly observed in black oaks already infected with armillaria root disease (*Armillaria mellea*) at the base. Scattered mature sugar pines were found with successful mountain pine beetle (*Dendroctonus ponderosae*) attack, some with previous white pine blister rust (*Cronartium ribicola*) infection on limbs.

Discussion

The district is currently conducting fuel reduction operations along the highway 245 to lower risk of spread and high severity fire if a wildfire were to occur. Some of these activities overlap with areas affected by WPB, so recent attacks and older dead trees are being removed concurrently with fuel treatments. A local logger is scheduled early this summer to remove dead trees around private homes and property. However, stands along Cedar Creek or other general forest stands (not defense or wildland-interface zones) with bark beetle-killed trees are not scheduled for treatment.

Figure 6. *Western Pine beetle still attacked these Ponderosa pines despite recent thinning treatments.*

Western pine beetle management focuses on prevention. Keeping stands vigorous and promoting tree health are the best approaches to preventing WPB-associated mortality. Suppression efforts do little to control beetles once populations are fairly high. Reducing overall stand susceptibility must reduce inter-tree resource competition and improve tree fitness to be able to repel beetle attack (Fettig et al. 2007). Recommendations to reduce stands to 55-70% of normal stocking will improve stand resistance against western pine beetle attack (DeMars et al. 1982). Treatments that create unfavorable beetle conditions will also increase tree resiliency during times of other severe tree stress, such as drought. In addition to dead trees, removal of declining trees (sanitation thinning) is also highly recommended to reduce potential host selection. Additional brush removal can also help areas like Hume Lake where heavy brush like manzanita or *Ceanothus* species will compete against trees for limited water.

Homeowners should be informed of proper strategies to improve tree longevity and prevent hazardous situations that compromise property and safety. Increasing tree spacing around private homes can relieve competitive stress to enhance tree resilience to bark beetles while reduce fuel hazard and property protection. Homeowners can irrigate selected trees to retain vigor during times of drought; infrequent deep watering around drip lines a few times before mid-summer is sufficient (Owen 2003). Private landowners have the option to utilize chemical sprays that have proven to protect individual high-value trees for 1-2 years; chemical treatments at the Forest landscape level would not be feasible or practical. Homeowners should talk with local arborists or certified applicators if considering chemical or other management options (Forest Health Protection 2009).

Slash and debris created by wind or snow create prime habitat for pine engraver beetles. Pine engravers (*Ips* species) prefer smaller diameter stems (less than 9 inches), but will infest larger material if available. Engravers become pests when large populations develop due to abundance of suitable host material, such as fresh log decks or sizable green slash piles. Also, slash produced January thru June optimal for brood development. Emerging brood can infest nearby residual live trees which are still susceptible for attack. DeGomez et al. (2008) thoroughly outlines effective slash treatments to prevent *Ips* and other bark beetles.

Proper treatment of slash will prevent most *Ips* outbreaks or unnecessary loss. For the current situation in the district, a few scattered broken limbs should not cause considerable population build-up; priority should be any areas where large amounts of slash have accumulated. Complete removal or movement of slash away from residual trees will protect from emerging brood. Chipping, burning, bucking limbs into small 2 foot bolts, scarifying bark, or moving slash into full sunlight are quick effective treatments that accelerate desiccation making material unsuitable for beetle attack. Small piles can be tightly covered with clear plastic (solarization) to kill live brood so wood can be later utilized. Slash combined into very large piles (at least 10-20 feet in height and width) has been found to contain second generation brood that move deeper into the pile rather than fly outward (Kegley et al. 1997). This may not be efficient with the random nature of windthrow debris thereby smaller piles that are treated before next flight are more practical. Pine engravers will not be attracted by cutting and piling of non-host material.

The district is conducting bark beetle prevention and fuel reduction treatments in and around high priority areas. Additional stands could be protected if forest health treatments were expanded to the landscape scale; mosaics of private land, young stands, non-hosts stands, etc. provide additional protection so area-wide incorporation would benefit ecosystems rather than isolated small patches. Forest Health Protection supports the efforts of the district, and competitive FHP funding opportunities are available for future prevention management. Please contact FHP for more information.

If you have any further questions or require additional information, please do not hesitate to call South Sierra Shared Service Area, 209-532-3671.

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Entomologist	Entomologist	Pathologist

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